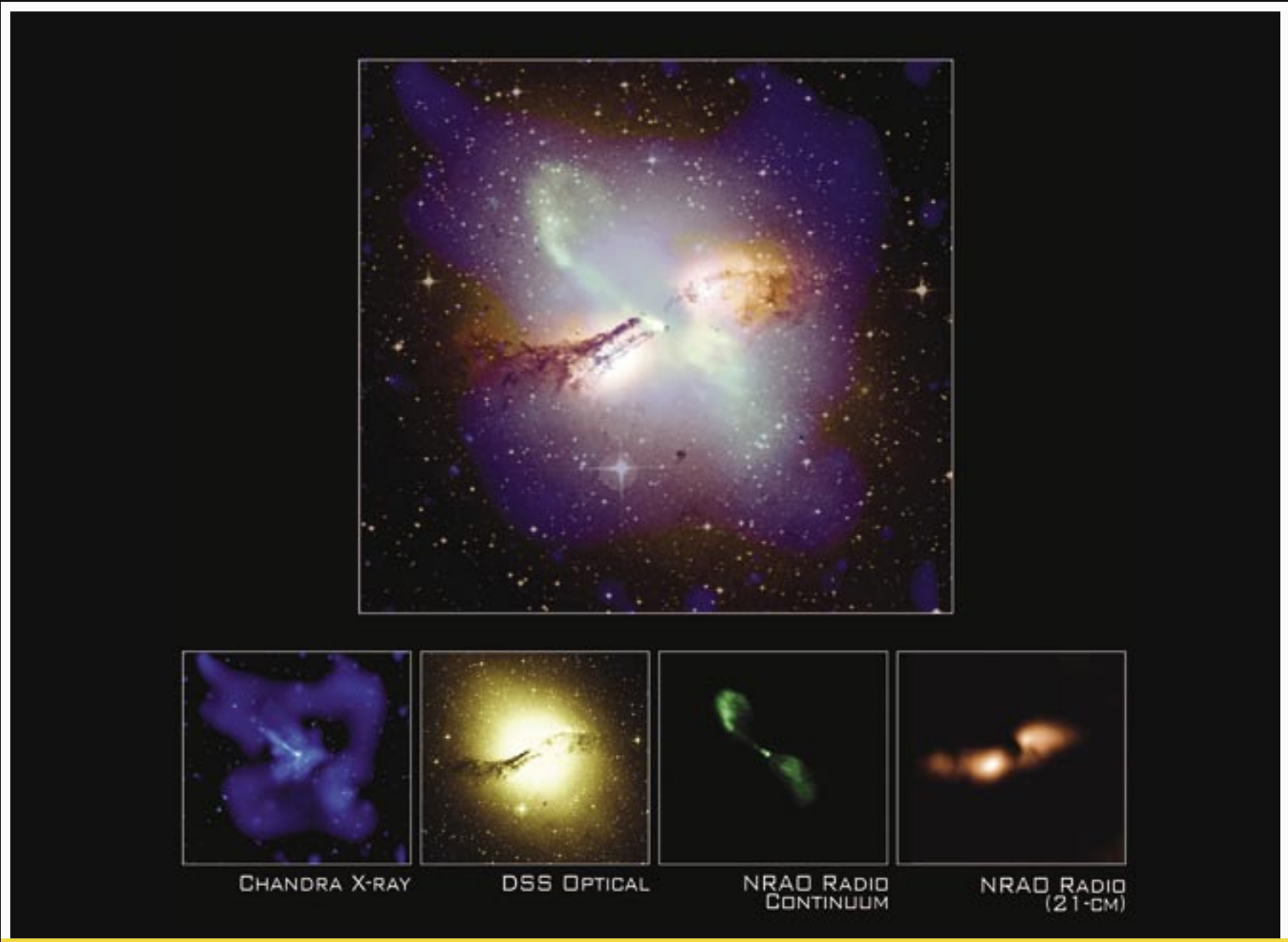


X Rays & Gamma Rays

Almost everything we know about the Universe we have learned by looking at the light that reaches Earth. But different energies of light tell us different things. To better understand our Universe, we look into space at all of the light of the electromagnetic spectrum. At GSFC’s Laboratory for High Energy Astrophysics, scientists study the most powerful events in the Universe – those seen in X-ray and gamma-ray light.



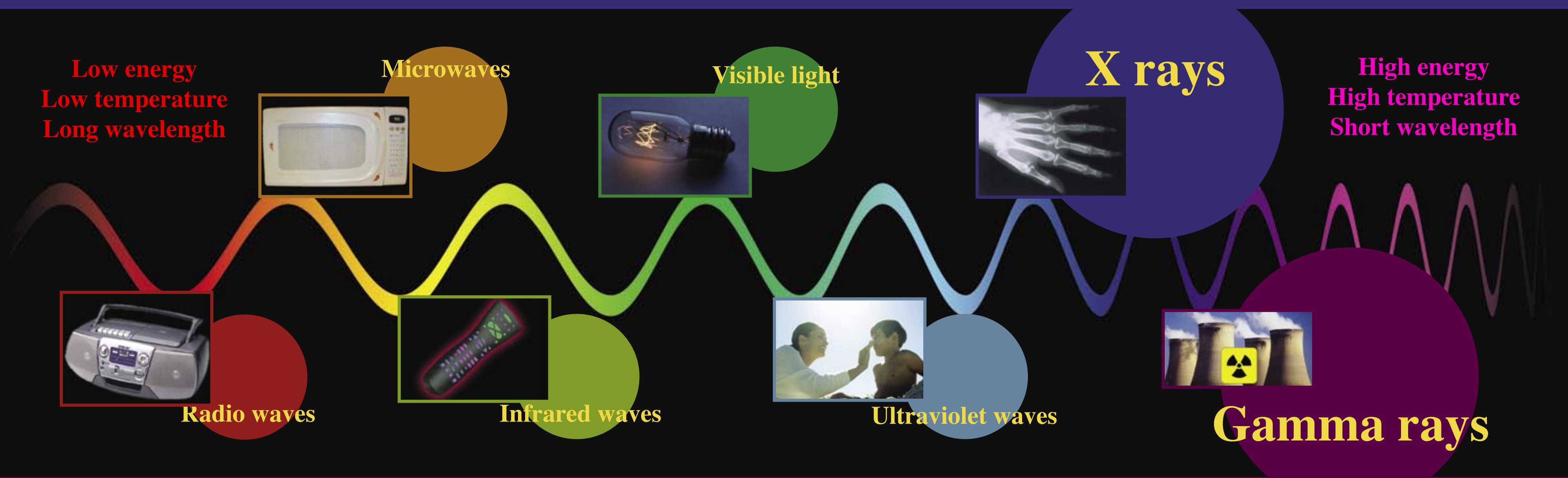
The active galaxy Centaurus-A looks very different at different wavelengths. Our eyes show us only part of the story.
Credits: X-ray (NASA/CXC); Radio 21-cm image (NRAO/VLA), Radio continuum image (NRAO/VLA); Optical (Digitized Sky Survey U.K. Schmidt Image/STScI)

X rays are high in the energy spectrum and are produced in space by collisions, explosions, and matter traveling at high speed. These are places where the temperature gets very hot: over a million degrees. X rays help us learn more about objects like supernovas, neutron stars, dark matter – even the Sun.

The most energetic X rays can travel through air for short distances (otherwise medical X-ray machines would not work), but they cannot pass all the way through Earth’s atmosphere. X-ray telescopes are flown above most of the Earth’s atmosphere, on rockets, balloons, or satellites.

Hot Fact

Astronomers don’t x-ray the stars like your dentist x-rays your teeth. Stars and galaxies produce X rays which we detect using satellites in orbit around the Earth. The stars are the “X-ray machines” and the satellites are the “X-ray film.”



Gamma rays are at the very top of the energy spectrum. In space, tremendous explosions and collisions and also energetic particles interacting with magnetic fields produce them. With gamma rays, we can peer into the hearts of solar flares, supernovas, neutron stars, and black holes.

Gamma rays arrive continuously from sources all across the sky, but they are also detected about once a day in the form of quick, powerful bursts from points in the sky. Gamma-ray bursts can last a fraction of a second or several minutes but shine a million trillion times as bright as the Sun. They are probably produced in explosions of distant massive stars and briefly become the most powerful events since the Big Bang!

Like X rays, gamma rays from space are absorbed by Earth’s atmosphere and must be studied with telescopes above it.

Goddard’s Laboratory for High Energy Astrophysics supports several X-ray and gamma-ray missions, including RXTE (Rossi X-ray Timing Explorer), XMM-Newton, INTEGRAL (International Gamma-Ray Astrophysics Laboratory), HETE-2 (the second High Energy Transience Explorer), the Swift gamma-ray burst explorer, Astro-E2, and Chandra (NASA’s X-ray Great Observatory).

Hot Fact

Gamma-ray bursts, which are seen about once a day as bright flashes of gamma rays, are probably produced when huge stars in distant parts of the Universe explode. Every gamma-ray burst is likely the birth of a black hole. These explosions are the most powerful events in the Universe since the Big Bang itself!